

SPECIFICATION

TO ALL WHOM IT MAY CONCERN:

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Be it known that I, Khalid M. Medhat, have invented the inventions described in
the following specification entitled:

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**METHOD AND APPARATUS
TO
CONTROL CELL SUBSTITUTION**

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RELATED APPLICATIONS

This patent application is a continuation of U.S. Patent Application 09/464,295,
which was filed on December 15, 1999; which is entitled "METHOD AND
10 APPARATUS TO CONTROL CELL SUBSTITUTION"; and which is hereby
incorporated by reference into this patent application.

FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

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Not applicable

MICROFICHE APPENDIX

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Not applicable

BACKGROUND OF THE INVENTION

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1. FIELD OF THE INVENTION

The invention is related to the field of communication systems, and in particular,
to a system that controls cell substitution for a call.

2. DESCRIPTION OF THE PRIOR ART

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When carrying calls, telecommunication systems break down calls into packets,
blocks, frames or cells depending on the protocol of the data network. The
telecommunication systems lose some cells for various reasons such as problems with
telecommunication devices. The telecommunication systems use cell substitution
methods to compensate for these lost cells. Some examples of cell substitution methods
35 are white noise, repeat last cell, and silence. White noise is typically background noise

inserted because of users' expectation of some noise. Repeat last cell is another method of inserting cells based on a calculation of previous cells.

FIG. 1 depicts a system level block diagram of a prior solution for using a cell substitution method. In FIG. 1, a call processing system 120 is disclosed in a pending
5 United States Patent Application number 09/435,534, entitled "System and Method for Processing a Call," filed on November 5, 1999, which is hereby incorporated by reference. FIG. 2 depicts a message sequence chart of a prior solution for using a cell substitution method. A local telephone company 110 transmits an Initial Address Message (IAM) in Signaling System #7 (SS7) for a call to a signaling processor 122. The
10 signaling processor 122 receives the IAM and processes the IAM. The signaling processor 122 then generates and transmits a route instruction for a routing system 124. Subsequent signaling messages for call set up are not shown for the sake of clarity.

The routing system 124 receives the route instruction from the signaling process 122. The routing system 124 uses one default cell substitution method that is provisioned
15 by the user for all calls received from the local telephone company 110. The routing system 124 then receives the call from the local telephone company 110 over a call link 112. The routing system 124 routes the call to an Asynchronous Transfer Mode (ATM) network 130 based on the route instruction. The routing system 124 uses the cell substitution method for lost or misinserted cells for the duration of the call.

20 One problem is that one cell substitution method does not provide the best performance for all different call types. The call types could be voice or data calls. Data calls are calls that carry data using modem, facsimile, or Switched 56. Different call types may use Signaling System #7, Integrated Services Digital Network, or Channel Associated Signaling for signaling and/or to carry the calls. Studies have shown that voice
25 calls are optimized when white noise is inserted for lost or misinserted cells. Studies have also shown that data call performance improves when the repeat last cell method is used to substitute for lost or misinserted cells.

One cell substitution method for all calls results in diminished quality for certain call types that perform better with another cell substitution method. For example, data
30 calls lose some data using a cell substitution method such as white noise that is optimal

for voice calls. To improve call quality, telecommunication service providers need to utilize different cell substitution methods for different type of calls.

SUMMARY OF THE INVENTION

- 5 The invention solves the above problem by determining a cell substitution method based on information for a call. A communication system advantageously uses an optimal cell substitution method for each different type of call. Thus, optimizing the performance of each call type with the appropriate optimal cell substitution method improves the quality for all call types. The communication system receives information for the call.
- 10 The communication system then determines the cell substitution method based on the information. The communication system generates an instruction to use the cell substitution method for the call. In one embodiment of the invention, the communication system determines a call type based on the information for the call and determines the cell substitution method based on the call type. In another embodiment, the communication
- 15 system uses the cell substitution method for the call based on the instruction.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a system level block diagram of a prior solution for using a cell substitution method.

- 20 FIG. 2 is a message sequence chart of a prior solution for using a cell substitution method.

FIG. 3 is a system level block diagram of an example of the invention.

FIG. 4 is a system level block diagram including a call processing system in an example of the invention.

- 25 FIG. 5 is a message sequence chart for a cell substitution method selected from an initial address message in an example of the invention.

FIG. 6 is a message sequence chart for a cell substitution method selected from a call type from a routing system in an example of the invention.

FIG. 7 is a flow chart for a signaling processor in an example of the invention.

- 30 FIG. 8 is a flow chart for a routing system in an example of the invention.

DETAILED DESCRIPTION OF THE INVENTION

Communication System To Control Cell Substitution

FIG. 3 depicts a system level block diagram of an example of the invention. In
5 FIG. 3, a communication device 310 is connected to a communication system 320 by a
call link 312. The communication system 320 is coupled to a call destination 330 by a call
link 322.

The communication device 310 could be any communications device configured
to transmit information for a call to the communication system 320. The information for
10 the call could be any data, signaling, or information related to the call. The information
for the call could be the call itself. One example of information for the call is an Initial
Address Message (IAM) in Signaling System #7. The call destination 330 could be any
system configured to receive calls from the communication system 320.

The communication system 320 could be any system configured to (1) receive
15 information for the call, (2) determine a cell substitution method based on the
information, and (3) generate an instruction to use the cell substitution method for the
call. The cell substitution method could be any method or process used to compensate for
lost or misinserted cells in a telecommunication service. In other embodiments of the
invention the cells are packets. Some examples of the cell substitution methods are white
20 noise, repeat last cell, and silence.

In operation, the communication device 310 transmits the information for the call
to the communication system 320. The communication system 320 receives the
information for the call. The communication system 320 then determines the cell
substitution method based on the information. The communication system 320 generates
25 an instruction to use the determined cell substitution method for the call.

Call Processing System To Control Cell Substitution

FIGS. 4-8 disclose one embodiment of the invention, but the invention is not
restricted to the configuration provided below. Those skilled in the art will appreciate
30 numerous variations in a communication system configuration and operation that are

within the scope of the invention. Those skilled in the art will also appreciate how the principles illustrated in this example can be used in other examples of the invention. A particular reference number in one figure refers to the same element in all of the other figures.

5 FIG. 4 depicts a system level block diagram including the call processing system 420 in an example of the invention. In FIG. 4, a call processing system 420 comprises a signaling processor 422 and a routing system 424. The signaling processor 422 is connected to a local telephone company 110 and the routing system 424. The routing system 424 is connected to the local telephone company 110 via a call link 112. The
10 routing system 424 is also connected to an Asynchronous Transfer Mode (ATM) network 130 via a call link 126. Those skilled in the art understand that other call processing systems can be connected to the call processing system 420 and either the local telephone company 110 or the ATM network 130. The numerous variations of multiple call processing systems are not shown for the sake of clarity.

15 FIG. 5 depicts a message sequence chart for a cell substitution method selected from an initial address message in an example of the invention. The local telephone company 110 transmits an IAM in SS7 for a call to the signaling processor 422. The signaling processor 422 receives the IAM and processes the IAM. The signaling processor 422 determines the call type from the IAM message. Some examples of call
20 types are voice and data calls. Data calls are calls that carry data using modem, facsimile, or Switched 56. Different call types may use Signaling System #7, Integrated Services Digital Network, or Channel Associated Signaling for signaling and/or to carry the calls. The signaling processor 422 then determines the cell substitution method based on the call type. For this embodiment, the call processor 422 determines to use white noise for
25 voice calls and repeat last cell for data calls.

 In one embodiment of the invention, the signaling processor 422 determines which cell substitution method to use for the call based on the incoming SS7 parameters from the IAM. Some examples of incoming SS7 parameters from the IAM are Calling Party Category, Echo Control Information, and Transmission Medium Requirement.

The signaling processor 422 then generates and transmits a route instruction including the cell substitution method that was determined for the call previously. In other embodiments of the invention, the route instruction could be any control message or instructions for the routing system 424. Subsequent signaling messages for call set up are not shown for the sake of clarity. The routing system 424 receives the route instruction including the cell substitution method from the signaling process 422. The routing system 424 uses the cell substitution method for lost or misinserted cells for the duration of the call. The routing system 424 then receives the call from the local telephone company 110 over the call link 112. The routing system 424 routes the call to the ATM network 130 based on the route instruction.

In another embodiment of the invention, FIG. 6 depicts a message sequence chart for a cell substitution method selected from a call type from the routing system 424 in an example of the invention. The local telephone company 110 transmits an IAM for a call to the signaling processor 422. The routing system 424 receives the call from the local telephone company 110. The routing system 424 then determines the call type based on the call. The routing system 424 generates and transmits a response message including the call type to the call processor 422. The call processor 422 receives and processes the response message.

The call processor 422 then determines the cell substitution method based on the call type. The call processor 422 generates and transmits a route instruction including the cell substitution method to the routing system 424 based on the IAM. The routing system 424 uses the cell substitution method for lost or misinserted cells for the duration of the call. The routing system 424 routes the call to the ATM network 130 based on the route instruction.

FIGS. 7-8 disclose an embodiment of the invention that supports selecting the cell substitution method from either an initial address message or a control message from the routing system 424. FIG. 7 depicts a flow chart for the signaling processor 422 in an example of the invention. FIG. 7 begins in step 700. The signaling processor 422 processes the IAM for the call from the local telephone company 110 in step 702. In step

704, the signaling processor 422 checks whether the IAM parameters exist to determine the cell substitution method.

If the IAM parameters exist, the signaling processor 422 determines the cell substitution method based on the incoming call type and the IAM parameters in step 706.

- 5 In step 708, the signaling processor 422 transmits a route instruction including the cell substitution method to the routing system 424.

- If the IAM parameters do not exist, the signaling processor 422 waits for the response message from the routing system 424 in step 710. In step 712, the signaling processor 422 checks if the signaling processor 422 received the response message from the routing system 424. If the signaling processor 422 received the response message, the signaling processor 422 processes the response message in step 714 before proceeding to step 706. If the signaling processor 422 has not received the response message, the signaling processor 422 checks if a timer has expired for waiting for the response message in step 716. If the timer has expired, the signaling processor 422 transmits the route instruction including a default cell substitution method to the routing system 424 in step 718. If the timer has not expired, the signaling processor 422 resets the timer in step 720.
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- FIG. 8 depicts a flow chart for the routing system 424 in an example of the invention. FIG. 8 begins in step 800. In step 802, the routing system 424 detects a new call from the call link 112. In step 804, the routing system 424 waits for a route instruction from the signaling processor 422. The routing system 424 checks if the route instruction was received from the signaling processor 422 in step 806.
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- If the routing system 424 did not receive the route instruction, the routing system 424 checks if a timer has expired for waiting for the route instruction in step 808. If the timer has not expired, the routing system 424 resets the timer in step 810. If the timer has expired, the routing system 424 determines the call type from the call via the call link 112 in step 814. The routing system 424 then transmits the response message including the call type to the signaling processor 422 in step 816.
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- If the routing system 424 did receive the route instruction, the routing system 424 checks if the route instruction includes the cell substitution method in step 812. If the
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route instruction does not include the cell substitution method, the routing system 424 determines the call type from the call via the call link 112 in step 814 before proceeding to step 816. If the route instruction does include the cell substitution method, the routing system 424 sets to use the cell substitution method for the call in step 818. The routing
5 system 424 then transmits a confirmation control message to the signaling processor 422 in step 820.

The above-described elements can be comprised of instructions that are stored on storage media. The instructions can be retrieved and executed by a processor. Some examples of instructions are software, program code, and firmware. Some examples of
10 storage media are memory devices, tape, disks, integrated circuits, and servers. The instructions are operational when executed by the processor to direct the processor to operate in accord with the invention. Those skilled in the art are familiar with instructions, processor, and storage media.

Those skilled in the art will appreciate variations of the above-described
15 embodiments that fall within the scope of the invention. As a result, the invention is not limited to the specific examples and illustrations discussed above, but only by the following claims and their equivalents.

20 CLAIMS:

I claim: